

WHAT IS CLAIMED IS:

- 1     1.     A system for measuring a three-dimensional object, said system  
2     comprising:  
3             a base;  
4             elongate measuring members operatively connected to said  
5     base such that said elongate measuring members can be displaced with  
6     respect to said base in response to a surface of said three-dimensional  
7     object; and  
8             means for determining displaced distances of said elongate  
9     measuring members due to said surface of said three-dimensional object,  
10    said displaced distances of said elongate measuring members being  
11    measurements of said surface of said three-dimensional object.
- 1     2.     The system of claim 1 wherein said elongate measuring members  
2     are operatively connected to said base such that said elongate measuring  
3     members can be displaced in a direction parallel to central axes of said  
4     elongate measuring members, said central axes corresponding to the  
5     lengths of said elongate measuring members.
- 1     3.     The system of claim 1 wherein said determining means includes  
2     mechanical sensors that are coupled to said base, said mechanical  
3     sensors being configured to mechanically sense displacements of said  
4     elongate measuring members.
- 1     4.     The system of claim 1 wherein said determining means includes  
2     optical sensors that are coupled to said base, said optical sensors being  
3     configured to optically sense displacements of said elongate measuring  
4     members.

1     5.     The system of claim 1 wherein said elongate measuring members  
2     include displacement information embedded in said elongate measuring  
3     members, and wherein said determining means includes optical sensors  
4     that are coupled to said base, said optical sensors being configured to  
5     optically read said displacement information embedded in said elongate  
6     measuring members.

1     6.     The system of claim 5 wherein said elongate measuring members  
2     have reflectivity that varies along the lengths of said elongate measuring  
3     members, said reflectivity of said elongate measuring members being said  
4     displacement information embedded in said elongate measuring members.

1     7.     The system of claim 5 wherein said elongate measuring members  
2     have different codes along the lengths of said elongate measuring  
3     members, said different codes of said elongate measuring members being  
4     said displacement information embedded in said elongate measuring  
5     members.

1     8.     The system of claim 1 wherein said elongate measuring members  
2     have transmissivity that varies along the lengths of said elongate  
3     measuring members, and wherein said determining means includes light  
4     sources and an imaging sensor, said light sources being positioned to  
5     project lights into said elongate measuring members at locations along the  
6     lengths of said elongate measuring members, said imaging sensor being  
7     positioned to capture an image of light-emitting ends of said elongate  
8     measuring members.

1     9.     The system of claim 8 further comprising a processing unit  
2     configured to process said image to determine intensities of lights emitted  
3     from said light-emitting ends of said elongate measuring members, said  
4     intensities of lights corresponding to said displaced distances of said  
5     elongate measuring members.

1     10.     A system for measuring a three-dimensional object, said system  
2     comprising:  
3                 a base;  
4                 elongate measuring members operatively connected to said  
5     base such that said elongate measuring members can be displaced with  
6     respect to said base in response to a surface of said three-dimensional  
7     object; and  
8                 a displacement-determining mechanism operatively coupled  
9     to said elongate measuring members, said displacement-determining  
10    mechanism being configured to determine displaced distances of said  
11    elongate measuring members due to said surface of said three-  
12    dimensional object, said displaced distances of said elongate measuring  
13    members being measurements of said surface of said three-dimensional  
14    object.

1     11.     The system of claim 10 wherein said elongate measuring members  
2     are operatively connected to said base such that said elongate measuring  
3     members can be displaced in a direction parallel to central axes of said  
4     elongate measuring members, said central axes corresponding to the  
5     lengths of said elongate measuring members.

1     12.     The system of claim 10 wherein said displacement-determining  
2     mechanism includes mechanical sensors that are coupled to said base,  
3     said mechanical sensors being configured to mechanically sense  
4     displacements of said elongate measuring members.

1     13.     The system of claim 10 wherein said displacement-determining  
2     mechanism includes optical sensors that are coupled to said base, said  
3     optical sensors being configured to optically sense displacements of said  
4     elongate measuring members.

1    14.    The system of claim 10 wherein said elongate measuring members  
2    include displacement information embedded in said elongate measuring  
3    members, and wherein said displacement-determining mechanism  
4    includes optical sensors that are coupled to said base, said optical sensors  
5    being configured to optically read said displacement information  
6    embedded in said elongate measuring members.

1    15.    The system of claim 14 wherein said elongate measuring members  
2    have reflectivity that varies along the lengths of said elongate measuring  
3    members, said reflectivity of said elongate measuring members being said  
4    displacement information embedded in said elongate measuring members.

1    16.    The system of claim 14 wherein said elongate measuring members  
2    have different codes along the lengths of said elongate measuring  
3    members, said different codes of said elongate measuring members being  
4    said displacement information embedded in said elongate measuring  
5    members.

1    17.    The system of claim 10 wherein said elongate measuring members  
2    have transmissivity that varies along the lengths of said elongate  
3    measuring members, and wherein said displacement-determining  
4    mechanism includes light sources and an imaging sensor, said light  
5    sources being positioned to project lights into said elongate measuring  
6    members at locations along the lengths of said elongate measuring  
7    members, said imaging sensor being positioned to capture an image of  
8    light-emitting ends of said elongate measuring members.

1    18.    The system of claim 17 further comprising a processing unit  
2    configured to process said image to determine intensities of lights emitted  
3    from said light-emitting ends of said elongate measuring members, said  
4    intensities of lights corresponding to said displaced distances of said  
5    elongate measuring members.

1     19.     A method for measuring a three-dimensional object, said method  
2     comprising:  
3                 engaging a surface of said three-dimensional object with  
4     displaceable measuring members, including displacing said displaceable  
5     measuring members in response to said surface of said three-dimensional  
6     object; and  
7                 determining displaced distances of said displaceable  
8     measuring members, said displaced distances providing measurements of  
9     said surface of said three-dimensional object.

1     20.     The method of claim 19 wherein said displacing of said  
2     displaceable measuring members includes displacing said displaceable  
3     measuring members in a direction parallel to central axes of said  
4     displaceable measuring members, said central axes corresponding to the  
5     lengths of said displaceable measuring members.

1     21.     The method of claim 19 wherein said determining of said displaced  
2     distances includes mechanically sensing displacements of said  
3     displaceable measuring members.

1     22.     The method of claim 19 wherein said determining of said displaced  
2     distances includes optically sensing displacements of said displaceable  
3     measuring members.

1     23.     The method of claim 19 wherein said determining of said displaced  
2     distances includes reading displacement information embedded in said  
3     displaceable measuring members.

1     24.     The method of claim 23 wherein said reading of said displacement  
2     information includes measuring light reflected off locations along the  
3     lengths of said displaceable measuring members, said displaceable  
4     measuring members having reflectivity that varies along the lengths of said  
5     displaceable measuring members.

1    25.    The method of claim 23 wherein said reading of said displacement  
2    information includes reading codes on said displaceable measuring  
3    members, said displaceable measuring members having different codes  
4    along the lengths of said displaceable measuring members.

1    26.    The method of claim 19 wherein said determining of said displaced  
2    distances includes projecting lights into said displaceable measuring  
3    members at locations along the lengths of said displaceable measuring  
4    members and capturing an image of light-emitting ends of said  
5    displaceable measuring members, said displaceable measuring members  
6    having transmissivity that varies along the lengths of said displaceable  
7    measuring members.

1    27.    The method of claim 26 further comprising processing said image to  
2    determine intensities of lights emitted from said light-emitting ends of said  
3    displaceable measuring members, said intensities of lights corresponding  
4    to said displaced distances of said elongate measuring members.